REMARKS/ARGUMENTS

Favorable reconsideration of this application in light of the following discussion is respectfully requested.

Claims 1-23 are presently pending in this case. Claim 21 is amended and new Claims 22 and 23 are added by the present amendment. As amended Claim 21 and new Claim 22 and 23 are supported by the original disclosure,[1] no new matter is added.

In the outstanding Official Action, the title was objected to; Claim 16 was rejected under 35 U.S.C. §103(a) as unpatentable over Schmid et al. ("Local Greyvalue Invariants for Image Retrieval," hereinafter "Schmid") in view of Roehrig et al. (U.S. Patent No. 5,815,591, hereinafter "Roehrig"); Claims 1-4, 8, and 20 were rejected under 35 U.S.C. §103(a) as unpatentable over Schmid and Roehrig and further in view of Matsuzaki et al. (U.S. Patent No. 6,804,683, hereinafter "Matsuzaki"); Claims 5-7, 9-15, and 21 were rejected under 35 U.S.C. §103(a) as unpatentable over Schmid and Roehrig in view of Matsuzaki and further in view of Lowe ("Object Recognition from Local Scale-Invariant Features"); Claims 11-15 were rejected under 35 U.S.C. §103(a) as unpatentable over Schmid in view of Lowe and further in view of Matsuzaki; Claim 17 was rejected under 35 U.S.C. §103(a) as unpatentable over Schmid and Roehrig in view of Lowe; Claim 18 was rejected under 35 U.S.C. §103(a) as unpatentable over Watanabe et al. (U.S. Patent No. 7,084,900, hereinafter "Watanabe") in view of Schmid and Roehrig; and Claim 19 was rejected under 35 U.S.C. §103(a) as unpatentable over Watanabe in view of Schmid and Roehrig and further in view of Lowe.

Claim 21 is amended to correct an informality.

With regard to the objection to title, the title was amended June 3, 2008 to be more descriptive. Accordingly, the objection to title is believed to be overcome.

[1]See, e.g., the specification at page 20, line 8 to page 21, line 17.

With regard to the rejection of Claim 16 as unpatentable over Schmid in view of Roehrig, that rejection is respectfully traversed.

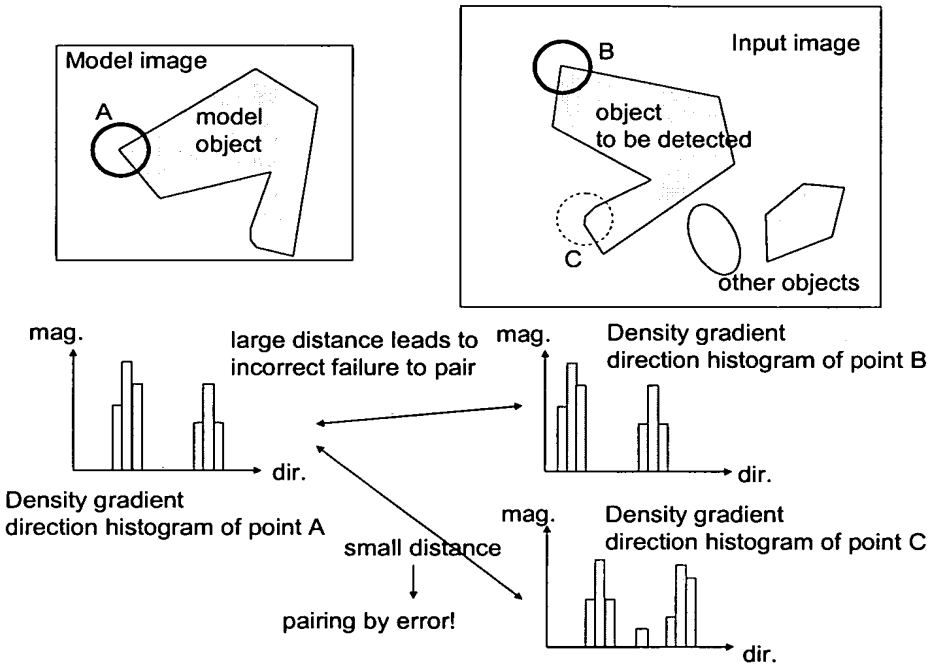
Claim 16 recites in part:

> extracting a feature point from each of the object image and the model image;
> extracting and retaining, as a feature quantity, a density gradient direction histogram at least acquired from density gradient information in a neighboring region at the feature point in each of the object image and the model image, the density gradient direction histogram storing a number of points near the feature point having each of a plurality of gradient directions;
> comparing the feature quantity of each feature point of the object image with the feature quantity of each feature point of the model image and generating a candidate-associated feature point pair having similar feature quantities; and
> detecting the presence or absence of the model on the object image using the candidate-associated feature point pair and estimating a position and an attitude of the model, if any,
> wherein the comparing ***itinerantly shifts one of the density gradient direction histograms of feature points to be compared in density gradient direction to find distances between the density gradient direction histograms and generates the candidate-associated feature point pair by assuming a shortest distance to be a distance between the density gradient direction histograms***.

Schmid describes a method for retrieving images from large image databases.[2] The outstanding Office Action cited sections 4.2, 4.2.1, 4.3, and 4.4 of Schmid as describing "comparing" as recited in Claim 16.[3] However, it is respectfully noted that Schmid only describes a ***single*** histogram T(k), and does not describe ***itinerantly shifting*** this histogram. The simple combination of Schmid's object recognition frame work and a utilization of density gradient direction histogram as described in Roehrig as a feature quantity retention method does not give a robust object recognition system, as this combined system has no robustness in the case where the model object to be detected appears in the input image with any rotation transformation. For example, the following figure shows that any simple

[2]See Schmid, abstract.
[3]See the outstanding Office Action at page 23, lines 4-12.

distance measurement (e.g. Euclid distance) between a density gradient direction histogram at a point A in the example model image and the one at the corresponding point B in the example input image, the distance (dissimilarity) value is large even though the two points correspond exactly. Thus, the proposed combination would erroneously fail to register a vote for this model image. Further, since the distance between the point A and the point C is the smallest for the unshifted histogram, these two points would be erroneously be considered the best match according to the proposed combination.



On the other hand, in the method recited in the Claim 16, the density gradient detection histogram of one of the model image or input image is ***itinerantly shifted*** and then compared to the density gradient direction of the other image to find distances between the density gradient direction histograms to generate the candidate-associated feature point pair by assuming a shortest distance to be a distance between the density gradient direction histograms. With this method, the distances between density gradient direction histograms of are calculated by ***ignoring any rotation transformation change***, and the example case can be handled reasonably: the distance between A and B gets reasonably small as one of the density

gradient detection histograms is itinerantly shifted and they are paired as candidate-associated feature point correctly.

Thus, it is respectfully submitted that Schmid does not teach "comparing" as defined in candidate-associated ***feature point pair*** Claim 16. Further, it is respectfully submitted that Roehrig does not teach or suggest this feature either. Consequently, Claim 16 is patentable over Schmid in view of Roehrig.

With regard to the rejection of Claim 1 and 20 as unpatentable over Schmid and Roehrig in view of Matsuzaki, that rejection is respectfully traversed.

Claim 1 recites in part "the feature quantity comparison means itinerantly shifts one of the density gradient direction histograms of feature points to be compared in density gradient direction to find distances between the density gradient direction histograms and generates the candidate-associated feature point pair by assuming a shortest distance to be a distance between the density gradient direction histograms."

The outstanding Office Action cited sections 4.2, 4.2.1, 4.3, and 4.4 of Schmid as describing "feature quantity comparison means" as recited in Claim 1.[4] However, as noted above, Schmid only describes a ***single*** histogram T(k), and does not describe ***itinerantly shifting*** this histogram. Accordingly, the proposed combination does not include a device that identifies rotated images as does the claimed invention. Thus, it is respectfully submitted that Schmid does not teach "feature quantity comparison means" as defined in Claim 1. Further, it is respectfully submitted that Roehrig and Matsuzaki do not cure this deficiency of Schmid. Consequently, Claim 1 (and Claims 2-10 dependent therefrom) is patentable over Schmid and Roehrig in view of Matsuzaki.

Claim 20 recites in part "the feature quantity comparison unit is configured to itinerantly shift one of the density gradient direction histograms of feature points to be

[4]See the outstanding Office Action at page 4, lines 8-13.

compared in density gradient direction to find distances between the density gradient direction histograms and to generate the candidate-associated feature point pair by assuming a shortest distance to be a distance between the density gradient direction histograms."

The outstanding Office Action cited sections 4.2, 4.2.1, 4.3, and 4.4 of Schmid as describing "a feature quantity comparison unit" as recited in Claim 20.[5] Schmid only describes a ***single*** histogram T(k), and does not describe ***itinerantly shifting*** this histogram. Accordingly, the proposed combination does not include a device that identifies rotated images as does the claimed invention. Thus, it is respectfully submitted that Schmid does not teach "a feature quantity comparison unit" as defined in Claim 20. Further, it is respectfully submitted that Roehrig and Matsuzaki do not cure this deficiency of Schmid. Consequently, Claim 20 is also patentable over Schmid and Roehrig in view of Matsuzaki.

With regard to the rejection of Claims 5-7, 9, and 10 as unpatentable over Schmid and Roehrig in view of Matsuzaki and further in view of Lowe, it is noted that Claims 5-7, 9, and 10 are dependent from Claim 1, and thus are believed to be patentable for at least the reasons discussed above. Further, it is respectfully submitted that Lowe does not cure any of the above-noted deficiencies of Schmid, Roehrig, and Matsuzaki. Accordingly, it is respectfully submitted that Claims 5-7, 9, and 10 are patentable over Schmid and Roehrig in view of Matsuzaki and further in view of Lowe.

With regard to the rejection of Claims 11 and 21 as unpatentable over Schmid and Roehrig in view of Lowe and further in view of Matsuzaki, that rejection is respectfully traversed.

Claim 11 recites in part "feature quantity comparison means for comparing the feature quantity of each feature point of the object image with the feature quantity of each feature

[5]See the outstanding Office Action at page 8, lines 8-13.

point of the model image and generating a candidate-associated ***feature point pair*** having similar feature quantities."

The outstanding Office Action cited sections 4.2 and 4.2.1 of Schmid as describing "feature quantity comparison means" as recited in Claim 11.[6] As noted above, Schmid compares a set of vectors representing ***multiple extracted interest points*** to a set of vectors representing query image I. The result of the comparison is a single, scalar value that is compared to a single, scalar threshold to determine if a vote should be cast. At no time is candidate-associated ***feature point pair*** including one feature point of the object image and one feature point of the model image generated. Thus, it is respectfully submitted that Schmid does not teach "feature quantity comparison means" as defined in Claim 11. Further, it is respectfully submitted that Roehrig, Lowe, and Matsuzaki do not cure this deficiency of Schmid. Consequently, Claim 11 (and Claims 12-15 dependent therefrom) is patentable over Schmid and Roehrig in view of Lowe and further in view of Matsuzaki.

Claim 21 recites in part "a feature quantity comparison unit configured to compare the feature quantity of each feature point of the object image with the feature quantity of each feature point of the model image and to generate a candidate-associated ***feature point pair*** having similar feature quantities."

The outstanding Office Action cited sections 4.2 and 4.2.1 of Schmid as describing "a feature quantity comparison unit" as recited in Claim 21.[7] As noted above, Schmid compares a set of vectors representing ***multiple extracted interest points*** to a set of vectors representing query image I. The result of the comparison is a single, scalar value that is compared to a single, scalar threshold to determine if a vote should be cast. At no time is a candidate-associated ***feature point pair*** including one feature point of the object image and one feature point of the model image generated. Thus, it is respectfully submitted that Schmid does not

[6]See the outstanding Office Action at page 14, lines 3-8.
[7]See the outstanding Office Action at page 19, lines 12-17.

teach "a feature quantity comparison unit" as defined in Claim 21. Further, it is respectfully submitted that Roehrig, Lowe, and Matsuzaki do not cure this deficiency of Schmid. Consequently, Claim 21 is also patentable over Schmid and Roehrig in view of Lowe and further in view of Matsuzaki.

With regard to the rejection of Claim 17 as unpatentable over Schmid and Roehrig in view of Lowe, that rejection is respectfully traversed.

Claim 17 recites in part "comparing the feature quantity of each feature point of the object image with the feature quantity of each feature point of the model image and generating a candidate-associated ***feature point pair*** having similar feature quantities."

The outstanding Office Action cited sections 4.2 and 4.2.1 of Schmid as describing "comparing" as recited in Claim 17.[8] As noted above, Schmid compares a set of vectors representing ***multiple extracted interest points*** to a set of vectors representing query image I. The result of the comparison is a single, scalar value that is compared to a single, scalar threshold to determine if a vote should be cast. At no time is a candidate-associated ***feature point pair*** including one feature point of the object image and one feature point of the model image generated. Thus, it is respectfully submitted that Schmid does not teach "comparing" as defined in Claim 17. Further, it is respectfully submitted that Lowe and Roehrig do not cure this deficiency of Schmid. Consequently, Claim 17 is patentable over Schmid and Roehrig in view of Lowe.

With regard to the rejection of Claim 18 as unpatentable over Watanabe in view of Schmid and Roehrig, that rejection is respectfully traversed.

Claim 18 recites in part "the feature quantity comparison means ***itinerantly shifts one of the density gradient direction histograms*** of feature points to be compared in density gradient direction to find distances between the density gradient direction histograms and

[8]See the outstanding Office Action at page 24, line 19 to page 25, line 2.

generates the candidate-associated feature point pair by assuming a shortest distance to be a distance between the density gradient direction histograms."

As noted above with respect to Claim 1, Schmid only describes a ***single*** histogram T(k), and does not describe ***itinerantly shifting*** this histogram. Accordingly, the proposed combination does not include a device that identifies rotated images as does the claimed invention. Thus, it is respectfully submitted that Schmid does not teach "feature quantity comparison means" as defined in Claim 18. Further, it is respectfully submitted that Watanabe and Roehrig do not cure this deficiency of Schmid. Consequently, Claim 18 is patentable over Watanabe in view of Schmid and Roehrig.

With regard to the rejection of Claim 19 as unpatentable over Watanabe in view of Schmid and Roehrig and further in view of Lowe, that rejection is respectfully traversed.

Claim 19 recites in part "feature quantity comparison means for comparing the feature quantity of each feature point of the input image with the feature quantity of each feature point of the model image and generating a candidate-associated ***feature point pair*** having similar feature quantities."

The outstanding Office Action cited sections 4.2.1 and 4.2.2 of Schmid as describing "feature quantity comparison means" as recited in Claim 19.[9] As noted above, Schmid compares a set of vectors representing ***multiple extracted interest points*** to a set of vectors representing query image I. The result of the comparison is a single, scalar value that is compared to a single, scalar threshold to determine if a vote should be cast. At no time is a candidate-associated ***feature point pair*** including one feature point of the object image and one feature point of the model image generated. Thus, it is respectfully submitted that Schmid does not teach "feature quantity comparison means" as defined in Claim 19. Further, it is respectfully submitted that Watanabe, Lowe, and Roehrig do not cure this deficiency of

[9]See the outstanding Office Action at page 23, lines 17-22.

Schmid. Consequently, Claim 19 is patentable over Watanabe in view of Schmid and Roehrig and further in view of Lowe.

New Claims 22 and 23 are supported at least by the specification at paragraphs 55, 57, and 113 of the published application. New Claims 22 and 23 are dependent on Claim 21, and thus are believed to be patentable for at least the reasons described above with respect to this claim. In addition, Claims 22 and 23 recite subject matter that further patentably defines over the cited references.

In particular, Claim 22 recites in part "the feature quantity comparison unit is configured to generate each candidate-associated feature point pair to include one feature point of the object image and one feature point of the model image with a dissimilarity less than a threshold." It is respectful submitted that Schmid does not determine a dissimilarity of ***one*** feature point of the object image and ***one*** feature point of the model image, much less compared it to a threshold, as Schmid compares a set of vectors representing ***multiple extracted interest points*** to a set of vectors representing query image I.

Further, Claim 23 recites in part "the feature quantity comparison unit is configured to generate the dissimilarity for each respective candidate-associated feature point pair by itinerantly shifting by one step the plurality of gradient directions for one of the object image and the model image to compute a number of similarities to a number of the plurality of gradient directions, and to take a minimum dissimilarity to be the dissimilarity." It is respectfully submitted that Schmid does not describe computing a plurality of similarities and taking a minimum dissimilarity to be the dissimilarity.

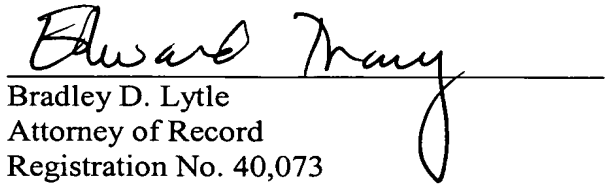
Further, it is respectfully submitted that Watanabe, Lowe, and Roehrig do not cure these deficiencies of Schmid. Consequently, Claims 22 and 23 are also patentable over the cited references.

Accordingly, the pending claims are believed to be in condition for formal allowance.

An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.



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